

CLAIMS

1. A process for making an electronic device which comprises applying a non-aqueous solder mask ink which is substantially free from organic solvent to a dielectric substrate containing electrically conductive metal circuitry, exposing the solder mask ink to actinic radiation and/or particle beam radiation optionally followed by thermal treatment, whereby the solder mask ink is applied to selected areas of the substrate under the control of a computer by ink jet printing and wherein the solder mask ink comprises the components:

A) 30 – 90 parts acrylate functional monomers which are mono or higher acrylate functional monomers comprising from 5 – 95% by weight of one or more monofunctional monomers;

B) 0.1 – 30 parts metal adhesion promoting organic compound;

C) 0 – 30 parts initiator;

D) 0 – 10 parts polymer and/or prepolymer;

E) 0 – 5 parts colorant;

F) 0 – 5 parts surfactant; and

wherein all parts are by weight.

2. A process as claimed in claim 1 wherein the viscosity of the solder mask ink is from 8 to 20 cPs (mPa.s) at 40°C.

3. A process as claimed in either claim 1 or claim 2 wherein the weight average molecular weight of the acrylate functional monomer is not greater than 2,000.

4. A process as claimed in any one of claims 1 to 3 wherein the acrylate functional monomer is isobornyl acrylate, tripropylene glycol diacrylate or trimethylolpropane ethoxylate triacrylate.

5. A process as claimed in any one of claims 1 to 4 wherein the amount of monofunctional acrylate monomer is 70-95% by weight of the acrylate-functional monomer (component A)).

6. A process as claimed in any one of claims 1 to 5 wherein the adhesion promoter is an acrylate functional monomer.

7. A process as claimed in any one of claims 1 to 6 wherein the adhesion promoter contains a metal chelant group which is a carboxylic acid.

8. A process as claimed in claim 7 wherein the adhesion promoter is (meth)acrylic acid.

9. A process as claimed in any one of claims 1 to 8 wherein the adhesion promoter is a polypropylene glycol tetra acrylate containing (meth)acrylic acid.

10. A process as claimed in claim 9 wherein the adhesion promoter has an acid value of not greater than 120 mg KOH/g.

11. A process as claimed in any one of claims 1 to 10 wherein the amount of adhesion promoter is not greater than 15 parts by weight.

12. A process as claimed in any one of claims 1 to 11 which includes the thermal treatment and wherein the thermal treatment is carried out at a temperature of from 80°C to 250°.

13. A process as claimed in any one of claims 1 to 12 wherein the dielectric substrate is a resin/fibre glass composite, polyester or polyimide.

14. A process as claimed in any one of claims 1 to 13 wherein the electrically conductive metal is copper.

15. A process as claimed in any one of claims 1 to 14 wherein the electronic device is a printed circuit board.

16. A process as claimed in any one of claims 1 to 15 wherein the solder mask ink has an acid value of not greater than 30 mg KOH/g.

17. A process as claimed in any one of claims 1 to 16 wherein the solder mask ink has a surface tension of from 20 to 40 mN/m.

18. A process as claimed in any one of claims 1 to 17 wherein the amount of initiator is not less than 5 parts.

19. A process as claimed in any one of claims 1 to 18 wherein the polymerised solder mask ink of 10 to 30µm thickness exhibits good adhesion to the dielectric substrate and conductive metal circuitry as determined by ASTR test method D3359-87.

20. A process as claimed in any one of claims 1 to 19 wherein the polymerised solder mask ink withstands molten solder for at least 10 seconds at 260°C according to IPC test method 3.7.2 of IPC-SM-840C.

21. A process as claimed in any one of claims 1 to 20 wherein the polymerised solder mask ink of 10 to 30µm thickness exhibits a pencil hardness of not less than 3H according to IPC test method TR 2.4.27.2 of IPC-TM-650.

22. A process as claimed in any one of claims 1 to 21 wherein the polymerised solder mask ink withstands dielectric breakdown of not less than 500 volts/25µm film thickness according to IPC test method TR 2.5.6.1 of IPC-SM-840C.

23. A process as claimed in any one of claims 1 to 22 wherein the polymerised solder mask ink exhibits a surface resistivity between adjacent metal tracks of the electrically conductive metal circuitry of not less than  $5 \times 10^9$  ohms according to test method 2.6.3.1 of IPC-SM-840C.

24. A process as claimed in any one of claims 1 to 23 wherein the number of parts of components A) + B) + C) + D) + E) + F) = 100.

25. A non-aqueous solder mask ink which is substantially free from organic solvents which comprises the components:

- A) 30 to 90 parts acrylate functional monomers which are mono or higher acrylate functional monomers comprising from 5 – 95% by weight of one or more monofunctional monomers ;
- B) 0.1 to 30 parts metal adhesion promoting compound;
- C) 5 to 30 parts initiator;
- D) 0 to 10 parts polymer and/or prepolymer;
- E) 0 to 5 parts colorant;
- F) 0 to 5 parts surfactant; and

wherein the ink has a viscosity of not greater than 30 cPs (mPa.s) at 40°C and all parts are by weight.

26. A non-aqueous solder mask ink which is substantially free from organic solvents which comprises the components:

- A) 30 to 90 parts acrylate functional monomers which are mono or higher acrylate functional monomers comprising from 5 – 95% by weight of one or more monofunctional monomers;
- B) 0.1 to 30 parts metal adhesion promoting organic compound containing one or

more carboxylic acid groups and having an acid value of not greater than 120 mg KOH/gm;

- C) 5 to 30 parts initiator;
- D) 0 to 10 parts polymer and/or prepolymer;
- E) 0 to 5 parts colorant; and
- F) 0 to 5 parts surfactant;

wherein the ink has a viscosity of not greater than 30 cPs (mPa.s) at 40°C and all parts are by weight.

27. A non-aqueous solder mask ink which is substantially free from organic solvents which comprises the components:

- A) 30 to 90 parts acrylate functional monomers which are mono or higher acrylate functional monomers comprising 5 – 95% by weight of one or more mono-functional monomers;
- B) 0.1 to 30 parts metal adhesion promoting organic compound containing one or more carboxylic acid groups;
- C) 5 to 30 parts initiator;
- D) 0 to 10 parts polymer and/or prepolymer;
- E) 0 to 5 parts colorant;
- F) 0 to 5 parts surfactant; and

wherein the acid value of the total solder mask ink is not greater than 30mg KOH/g and all parts are by weight.

28. An ink as claimed in any one of claims 21 to 25 wherein the number of parts of components A) + B) + C) + D) + E) + F) = 100.

29. A cartridge for an ink jet printer comprising a chamber and an ink wherein the ink is present in the chamber and the ink is a solder mask ink as claimed in any one of claims 25 to 28.

30. An electronic device obtained by a process according to any one of claims 1 to 24.